

What is Claimed Is:

1. A magnetic recording medium including at least one Cu-containing magnetic recording layer (CuML) comprised of a Cu-containing magnetic alloy material selected from the group consisting of:

5 (a) a CoCrPtBCu alloy having a composition represented by the formula  $\text{Co}_{100-x-y-z-a}\text{Cr}_x\text{Pt}_y\text{B}_z\text{Cu}_a$ , wherein  $0 < x \leq 20$ ,  $0 < y \leq 30$ ,  $0 < z \leq 24$ , and  $0 < a \leq 10$ ;

(b) a CoCrPtBCu alloy having a composition represented by the formula  $\text{Co}_{100-x-y-z-a}\text{Cr}_x\text{Pt}_y\text{B}_z\text{Cu}_a$ , wherein  $0 < x \leq 30$ ,  $0 < y \leq 30$ ,  $7 < z \leq 24$ , and  $0 < a \leq 10$ ; and

10 (c) a CoCrTaCu alloy having a composition represented by the formula  $\text{Co}_{100-x-y-a}\text{Cr}_x\text{Ta}_y\text{Cu}_a$ , containing less than 30 at. % Cr, up to 8 at. % Ta, up to 10 at. % Cu.

2. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy materials (a) and (b) further include at least one element selected from the group consisting of: Si, Ti, V, Fe, Ni, Ge, Zr, Nb, Mo, Ru, Ag, Hf, Ta, W, and Au.

3. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy materials (a) and (b) are Cr-rich and contain more than 16 at. % Cr.

4. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy materials (a) and (b) are Cr-poor and contain less than 16 at. % Cr.

5. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy material (c) further includes at least one element selected from the group consisting of: B, Si, Ti, V, Fe, Ni, Ge, Zr, Nb, Mo, Ru, Ag, Hf, Pt, W, and Au.

6. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy material (c) is Cr-rich and the following condition obtains:  $16 \leq x \leq 30$ ,  $0 < y \leq 30$ , and  $0 < \alpha \leq 10$ .

7. The medium as in claim 1, wherein:

said Cu-containing magnetic alloy material (c) is Cr-poor and the following condition obtains:  $0 < x \leq 16$ ,  $0 < y \leq 30$ , and  $0 < \alpha \leq 10$ .

8. The medium as in claim 1, further including at least one Cu-containing magnetic recording layer (CuML) comprised of a Cu-containing magnetic alloy material having a composition represented by the formula  $\text{Co}_{100-x-y-z-\alpha}\text{Cr}_x\text{Pt}_y\text{B}_z\text{Cu}_\alpha$ , wherein  $0 < x \leq 30$ ,  $0 < y \leq 30$ ,  $0 < z \leq 24$ ,  $0 < \alpha \leq 10$ , and  $x + z \leq 35$ .

9. The medium as in claim 1, further including at least one Cu-free magnetic recording layer (ML).

10. The medium as in claim 9, wherein said at least one Cu-free magnetic recording layer (ML) comprises a magnetic alloy material selected from among CoCr and CoCr containing at least one element selected from the group consisting of B, Si, Ti, V, Fe, Ni, Ge, Zr, Nb, Mo, Ru, Ag, Hf, W, Pt, and Au.

11. The medium as in claim 9, comprising:

a stacked bi-layer structure  $[\text{ML}/\text{CuML}]_n$ , where  $n = 1$  to 10 and each  $[\text{ML}/\text{CuML}]$  bi-layer is comprised of a Cu-free magnetic recording layer (ML) and an overlying Cu-containing magnetic recording layer (CuML) of a said Cu-containing magnetic alloy material (a), (b), or (c).

12. The medium as in claim 9, comprising:

a stacked tri-layer structure [ML/Cr-rich CuML/Cr-poor CuML]<sub>n</sub>, where  $n = 1$  to 10 and each [ML/Cr-rich CuML/Cr-poor CuML] tri-layer is comprised, in overlying sequence, of a Cu-free magnetic recording layer (ML), a Cr-rich, Cu-containing magnetic recording layer (Cr-rich CuML) of a Cr-rich magnetic alloy material (a), (b), or (c), and an overlying Cr-poor, Cu-containing magnetic recording layer (Cr-poor CuML) of a Cr-poor magnetic alloy material (a), (b), or (c).

13. The medium as in claim 9, comprising:

a stacked tri-layer structure [ML]<sub>i1</sub>[CuML]<sub>j</sub>[ML]<sub>i2</sub>, where  $i_1$  and  $i_2$  each = 0 - 10,  $j = 1 - 10$ , and  $i_1 + i_2 + j \geq 2$ , comprised of 0 - 10 stacked Cu-free magnetic recording layers (ML)  $i_1$  and  $i_2$  and 1 - 10 stacked Cu-containing magnetic recording layers (CuML) each comprised of a Cu-containing magnetic alloy material (a), (b), or (c).

14. The medium as in claim 9, comprising:

a stacked layer structure [ML]<sub>i1</sub>[Cr-rich CuML]<sub>j</sub>[ML]<sub>i2</sub>[Cr-poor CuML]<sub>k</sub>[ML]<sub>i3</sub>, where  $i_1$ ,  $i_2$ , and  $i_3$  each = 0 - 10,  $j$  and  $k$  each = 1 - 10, and  $i_1 + i_2 + i_3 + j + k \geq 3$ , comprised of 0 - 10 stacked Cu-free magnetic layers (ML)  $i_1$ ,  $i_2$ , and  $i_3$ , 1 - 10 stacked Cr-rich, Cu-containing magnetic layers (Cr-rich CuML) each comprised of a Cu-containing magnetic alloy (a), (b), or (c), and 1 - 10 stacked Cr-poor, Cu-containing magnetic layers (Cr-poor CuML) each comprised of a Cu-containing magnetic alloy (a), (b), or (c).

15. The medium as in claim 1, comprising:

a stacked bi-layer structure [Cr-rich CuML/Cr-poor CuML]<sub>n</sub>, where  $n = 1$  to 10 and said [Cr-rich CuML/Cr-poor CuML] bi-layer is comprised of a Cr-rich, Cu-containing magnetic recording layer (Cr-rich CuML) of a Cr-rich magnetic

- 5 alloy material (a), (b), or (c) and an overlying Cr-poor, Cu-containing magnetic recording layer (Cr-poor CuML) of a Cr-poor magnetic alloy material (a), (b), or (c).

16. The medium as in claim 1, in the form of an anti-ferromagnetically coupled (AFC) medium, comprising:

- a bottom magnetic layer spaced apart from a top magnetic recording layer by a non-magnetic spacer layer, said top magnetic recording layer including a  
5 Cu-containing magnetic recording layer (CuML) comprised of a said Cu-containing magnetic alloy material (a), (b), or (c).

17. The medium as in claim 16, wherein:

said spacer layer comprises a non-magnetic material selected from the group consisting of: Ru, Rh, Ir, Cr, Cu, Re, V, and their alloys.

18. The medium as in claim 16, wherein:

said top magnetic recording layer further includes at least one Cu-free magnetic recording layer (ML).

19. The medium as in claim 16, further comprising:

a top interface layer between said top magnetic recording layer and said spacer layer for improving RKKY coupling of said top and bottom magnetic layers.

20. The medium as in claim 1, comprising:

a non-magnetic substrate and non-magnetic seed and underlayers.

21. The medium as in claim 20, further comprising:

at least one non-magnetic interlayer.